

SEQUENCE LISTING

<110> YOKOYAMA, KEIICHI
NAKAMURA, NAMI
MIWA, TETSUYA
SEGURO, KATSUYA

<120> PROCESS FOR PRODUCING MICROBIAL TRANSGLUTAMINASE

<130> 0010-0937-0

<140> 09/109,063

<141> 1998-07-02

<150> JP 180010/1997

<151> 1997-07-04

<160> 62

<170> PatentIn Ver. 2.0

<210> 1

<211> 331

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial
Sequence:TRANSGLUTAMINASE

<400> 1

Asp Ser Asp Asp Arg Val Thr Pro Pro Ala Glu Pro Leu Asp Arg Met
1 5 10 15

Pro Asp Pro Tyr Arg Pro Ser Tyr Gly Arg Ala Glu Thr Val Val Asn
20 25 30

Asn Tyr Ile Arg Lys Trp Gln Gln Val Tyr Ser His Arg Asp Gly Arg
35 40 45

Lys Gln Gln Met Thr Glu Glu Gln Arg Glu Trp Leu Ser Tyr Gly Cys
50 55 60

Val Gly Val Thr Trp Val Asn Ser Gly Gln Tyr Pro Thr Asn Arg Leu
65 70 75 80

Ala Phe Ala Ser Phe Asp Glu Asp Arg Phe Lys Asn Glu Leu Lys Asn
85 90 95

Gly Arg Pro Arg Ser Gly Glu Thr Arg Ala Glu Phe Glu Gly Arg Val
100 105 110

Ala Lys Glu Ser Phe Asp Glu Glu Lys Gly Phe Gln Arg Ala Arg Glu
115 120 125

Val	Ala	Ser	Val	Met	Asn	Arg	Ala	Leu	Glu	Asn	Ala	His	Asp	Glu	Ser
130						135					140				
Ala	Tyr	Leu	Asp	Asn	Leu	Lys	Lys	Glu	Leu	Ala	Asn	Gly	Asn	Asp	Ala
145					150					155					160
Leu	Arg	Asn	Glu	Asp	Ala	Arg	Ser	Pro	Phe	Tyr	Ser	Ala	Leu	Arg	Asn
				165					170					175	
Thr	Pro	Ser	Phe	Lys	Glu	Arg	Asn	Gly	Gly	Asn	His	Asp	Pro	Ser	Arg
			180					185					190		
Met	Lys	Ala	Val	Ile	Tyr	Ser	Lys	His	Phe	Trp	Ser	Gly	Gln	Asp	Arg
		195					200					205			
Ser	Ser	Ser	Ala	Asp	Lys	Arg	Lys	Tyr	Gly	Asp	Pro	Asp	Ala	Phe	Arg
	210					215					220				
Pro	Ala	Pro	Gly	Thr	Gly	Leu	Val	Asp	Met	Ser	Arg	Asp	Arg	Asn	Ile
225					230					235					240
Pro	Arg	Ser	Pro	Thr	Ser	Pro	Gly	Glu	Gly	Phe	Val	Asn	Phe	Asp	Tyr
				245					250					255	
Gly	Trp	Phe	Gly	Ala	Gln	Thr	Glu	Ala	Asp	Ala	Asp	Lys	Thr	Val	Trp
			260					265					270		
Thr	His	Gly	Asn	His	Tyr	His	Ala	Pro	Asn	Gly	Ser	Leu	Gly	Ala	Met
		275					280					285			
His	Val	Tyr	Glu	Ser	Lys	Phe	Arg	Asn	Trp	Ser	Glu	Gly	Tyr	Ser	Asp
	290					295					300				
Phe	Asp	Arg	Gly	Ala	Tyr	Val	Ile	Thr	Phe	Ile	Pro	Lys	Ser	Trp	Asn
305					310					315					320
Thr	Ala	Pro	Asp	Lys	Val	Lys	Gln	Gly	Trp	Pro					
				325					330						

<210> 2

<211> 993

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:SYNTHETIC DNA

<220>

<221> CDS

<222> (1)..(993)

<223> IDENTIFICATION METHOD: S

<400> 2

gat tct gac gat cgt gtt act cca cca gct gaa cca ctg gat cgt atg
Asp Ser Asp Asp Arg Val Thr Pro Pro Ala Glu Pro Leu Asp Arg Met

48

1	5	10	15		
cca gat cca tat cgt cca tct tat ggt cgt gct gaa act gtt gtt aat	Pro Asp Pro Tyr Arg Pro Ser Tyr Gly Arg Ala Glu Thr Val Val Asn	20	25	30	96
aat tat att cgt aaa tgg caa caa gtt tat tct cat cgt gat ggt cgt	Asn Tyr Ile Arg Lys Trp Gln Gln Val Tyr Ser His Arg Asp Gly Arg	35	40	45	144
aaa caa caa atg act gaa gaa caa cgt gaa tgg ctg tct tat ggt tgc	Lys Gln Gln Met Thr Glu Glu Gln Arg Glu Trp Leu Ser Tyr Gly Cys	50	55	60	192
gtt ggt gtt act tgg gtt aac tct ggt cag tat ccg act aac cgt ctg	Val Gly Val Thr Trp Val Asn Ser Gly Gln Tyr Pro Thr Asn Arg Leu	65	70	75	240
gca ttc gct tcc ttc gat gaa gat cgt ttc aag aac gaa ctg aag aac	Ala Phe Ala Ser Phe Asp Glu Asp Arg Phe Lys Asn Glu Leu Lys Asn	85	90	95	288
ggt cgt ccg cgt tct ggt gaa act cgt gct gaa ttc gaa ggt cgt gtt	Gly Arg Pro Arg Ser Gly Glu Thr Arg Ala Glu Phe Glu Gly Arg Val	100	105	110	336
gct aag gaa tcc ttc gat gaa gag aaa ggc ttc cag cgt gct cgt gaa	Ala Lys Glu Ser Phe Asp Glu Glu Lys Gly Phe Gln Arg Ala Arg Glu	115	120	125	384
gtt gct tct gtt atg aac cgt gct cta gag aac gct cat gat gaa tct	Val Ala Ser Val Met Asn Arg Ala Leu Glu Asn Ala His Asp Glu Ser	130	135	140	432
gct tac ctg gat aac ctg aag aag gaa ctg gct aac ggt aac gat gct	Ala Tyr Leu Asp Asn Leu Lys Lys Glu Leu Ala Asn Gly Asn Asp Ala	145	150	155	480
ctg cgt aac gaa gat gct cgt tct ccg ttc tac tct gct ctg cgt aac	Leu Arg Asn Glu Asp Ala Arg Ser Pro Phe Tyr Ser Ala Leu Arg Asn	165	170	175	528
act ccg tcc ttc aaa gaa cgt aac ggt ggt aac cat gat ccg tct cgt	Thr Pro Ser Phe Lys Glu Arg Asn Gly Gly Asn His Asp Pro Ser Arg	180	185	190	576
atg aaa gct gtt atc tac tct aaa cat ttc tgg tct ggt cag gat aga	Met Lys Ala Val Ile Tyr Ser Lys His Phe Trp Ser Gly Gln Asp Arg	195	200	205	624
tct tct tct gct gat aaa cgt aaa tac ggt gat ccg gat gca ttc cgt	Ser Ser Ser Ala Asp Lys Arg Lys Tyr Gly Asp Pro Asp Ala Phe Arg	210	215	220	672
ccg gct ccg ggt act ggt ctg gta gac atg tct cgt gat cgt aac atc	Pro Ala Pro Gly Thr Gly Leu Val Asp Met Ser Arg Asp Arg Asn Ile				720

225	230	235	240	
ccg cgt tct ccg act tct ccg ggt gaa ggc ttc gtt aac ttc gat tac				768
Pro Arg Ser Pro Thr Ser Pro Gly Glu Gly Phe Val Asn Phe Asp Tyr	245	250	255	
ggt tgg ttc ggt gct cag act gaa gct gat gct gat aag act gta tgg				816
Gly Trp Phe Gly Ala Gln Thr Glu Ala Asp Ala Asp Lys Thr Val Trp	260	265	270	
acc cat ggt aac cat tac cat gct ccg aac ggt tct ctg ggt gct atg				864
Thr His Gly Asn His Tyr His Ala Pro Asn Gly Ser Leu Gly Ala Met	275	280	285	
cat gta tac gaa tct aaa ttc cgt aac tgg tct gaa ggt tac tct gac				912
His Val Tyr Glu Ser Lys Phe Arg Asn Trp Ser Glu Gly Tyr Ser Asp	290	295	300	
ttc gat cgt ggt gct tac gtt atc acc ttc att ccg aaa tct tgg aac				960
Phe Asp Arg Gly Ala Tyr Val Ile Thr Phe Ile Pro Lys Ser Trp Asn	305	310	315	320
act gct ccg gac aaa gtt aaa cag ggt tgg ccg				993
Thr Ala Pro Asp Lys Val Lys Gln Gly Trp Pro	325	330		

<210> 3

<211> 1519

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:SYNTHETIC DNA

<220>

<221> CDS

<222> (87)..(1082)

<400> 3

ttcccctggt gacaattaat catcgaacta gttaactagt acgcaagttc acgtaaaaag 60

ggtatcgatt agtaaggagg tttaaa atg gat tct gac gat cgt gtt act cca	113
Met Asp Ser Asp Asp Arg Val Thr Pro	
1 5	

cca gct gaa cca ctg gat cgt atg cca gat cca tat cgt cca tct tat	161
Pro Ala Glu Pro Leu Asp Arg Met Pro Asp Pro Tyr Arg Pro Ser Tyr	
10 15 20 25	

ggt cgt gct gaa act gtt gtt aat aat tat att cgt aaa tgg caa caa	209
Gly Arg Ala Glu Thr Val Val Asn Asn Tyr Ile Arg Lys Trp Gln Gln	
30 35 40	

ggt tat tct cat cgt gat ggt cgt aaa caa caa atg act gaa gaa caa	257
Val Tyr Ser His Arg Asp Gly Arg Lys Gln Gln Met Thr Glu Glu Gln	

45					50					55						
cgt	gaa	tgg	ctg	tct	tat	ggg	tgc	gtt	ggg	gtt	act	tgg	gtt	aac	tct	305
Arg	Glu	Trp	Leu	Ser	Tyr	Gly	Cys	Val	Gly	Val	Thr	Trp	Val	Asn	Ser	
	60						65					70				
ggg	cag	tat	ccg	act	aac	cgt	ctg	gca	ttc	gct	tcc	ttc	gat	gaa	gat	353
Gly	Gln	Tyr	Pro	Thr	Asn	Arg	Leu	Ala	Phe	Ala	Ser	Phe	Asp	Glu	Asp	
	75					80					85					
cgt	ttc	aag	aac	gaa	ctg	aag	aac	ggg	cgt	ccg	cgt	tct	ggg	gaa	act	401
Arg	Phe	Lys	Asn	Glu	Leu	Lys	Asn	Gly	Arg	Pro	Arg	Ser	Gly	Glu	Thr	
	90				95					100					105	
cgt	gct	gaa	ttc	gaa	ggg	cgt	gtt	gct	aag	gaa	tcc	ttc	gat	gaa	gag	449
Arg	Ala	Glu	Phe	Glu	Gly	Arg	Val	Ala	Lys	Glu	Ser	Phe	Asp	Glu	Glu	
				110					115						120	
aaa	ggc	ttc	cag	cgt	gct	cgt	gaa	gtt	gct	tct	gtt	atg	aac	cgt	gct	497
Lys	Gly	Phe	Gln	Arg	Ala	Arg	Glu	Val	Ala	Ser	Val	Met	Asn	Arg	Ala	
			125					130					135			
cta	gag	aac	gct	cat	gat	gaa	tct	gct	tac	ctg	gat	aac	ctg	aag	aag	545
Leu	Glu	Asn	Ala	His	Asp	Glu	Ser	Ala	Tyr	Leu	Asp	Asn	Leu	Lys	Lys	
			140					145					150			
gaa	atg	gct	aac	ggg	aac	gat	gct	ctg	cgt	aac	gaa	gat	gct	cgt	tct	593
Glu	Leu	Ala	Asn	Gly	Asn	Asp	Ala	Leu	Arg	Asn	Glu	Asp	Ala	Arg	Ser	
	155					160						165				
ccg	ttc	tac	tct	gct	ctg	cgt	aac	act	ccg	tcc	ttc	aaa	gaa	cgt	aac	641
Pro	Phe	Tyr	Ser	Ala	Leu	Arg	Asn	Thr	Pro	Ser	Phe	Lys	Glu	Arg	Asn	
	170				175					180					185	
ggg	ggg	aac	cat	gat	ccg	tct	cgt	atg	aaa	gct	gtt	atc	tac	tct	aaa	689
Gly	Gly	Asn	His	Asp	Pro	Ser	Arg	Met	Lys	Ala	Val	Ile	Tyr	Ser	Lys	
				190					195						200	
cat	ttc	tgg	tct	ggg	cag	gat	aga	tct	tct	tct	gct	gat	aaa	cgt	aaa	737
His	Phe	Trp	Ser	Gly	Gln	Asp	Arg	Ser	Ser	Ser	Ala	Asp	Lys	Arg	Lys	
			205					210						215		
tac	ggg	gat	ccg	gat	gca	ttc	cgt	ccg	gct	ccg	ggg	act	ggg	ctg	gta	785
Tyr	Gly	Asp	Pro	Asp	Ala	Phe	Arg	Pro	Ala	Pro	Gly	Thr	Gly	Leu	Val	
			220				225					230				
gac	atg	tct	cgt	gat	cgt	aac	atc	ccg	cgt	tct	ccg	act	tct	ccg	ggg	833
Asp	Met	Ser	Arg	Asp	Arg	Asn	Ile	Pro	Arg	Ser	Pro	Thr	Ser	Pro	Gly	
	235					240					245					
gaa	ggc	ttc	gtt	aac	ttc	gat	tac	ggg	tgg	ttc	ggg	gct	cag	act	gaa	881
Glu	Gly	Phe	Val	Asn	Phe	Asp	Tyr	Gly	Trp	Phe	Gly	Ala	Gln	Thr	Glu	
	250				255					260					265	
gct	gat	gct	gat	aag	act	gta	tgg	acc	cat	ggg	aac	cat	tac	cat	gct	929
Ala	Asp	Ala	Asp	Lys	Thr	Val	Trp	Thr	His	Gly	Asn	His	Tyr	His	Ala	

270	275	280	
ccg aac ggt tct ctg ggt gct atg cat gta tac gaa tct aaa ttc cgt			977
Pro Asn Gly Ser Leu Gly Ala Met His Val Tyr Glu Ser Lys Phe Arg			
285	290	295	
aac tgg tct gaa ggt tac tct gac ttc gat cgt ggt gct tac gtt atc			1025
Asn Trp Ser Glu Gly Tyr Ser Asp Phe Asp Arg Gly Ala Tyr Val Ile			
300	305	310	
acc ttc att ccg aaa tct tgg aac act gct ccg gac aaa gtt aaa cag			1073
Thr Phe Ile Pro Lys Ser Trp Asn Thr Ala Pro Asp Lys Val Lys Gln			
315	320	325	
ggt tgg ccg taatgaaagc ttggatctct aattactgga cttcacacag			1122
Gly Trp Pro			
330			
actaaaatag acatatctta tattatgtga ttttgtgaca tttcctagat gtgaggtgga			1182
ggtgatgtat aaggtagatg atgacctct acgccggacg catcgtggcc ggcatcaccg			1242
gcgcacagg tgcggttgct ggcgcctata tcgccgacat caccgatggg gaagatcggg			1302
ctcgccactt cgggctcatg agcgcttggt tcggcgtggg tatggtggca ggccccgtgg			1362
ccgggggact gttggggcgcc atctccttgc atgcaccatt ccttgccggcg gcggtgetca			1422
acggcctcaa cctactactg ggctgcttcc taatgcagga gtcgcataag ggagagcgtc			1482
gagagccccgc ctaatgagcg ggcttttttt tcagctg			1519
<210> 4			
<211> 39			
<212> DNA			
<213> Artificial Sequence			
<220>			
<223> Description of Artificial Sequence:SYNTHETIC DNA			
<400> 4			
aattcatcga ttagtaagga ggttttaaataa ggattctga			39
<210> 5			
<211> 41			
<212> DNA			
<213> Artificial Sequence			
<220>			
<223> Description of Artificial Sequence:SYNTHETIC DNA			
<400> 5			
cgatcgtcag aatccatttt aaacctcctt actaatcgat g			41

<210> 6
<211> 41
<212> DNA
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:SYNTHETIC DNA

<400> 6
cgatcgtgtt actccaccag ctgaaccact ggatcgtatg c

41

<210> 7
<211> 41
<212> DNA
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:SYNTHETIC DNA

<400> 7
gatcgggcat acgatccagt ggttcagctg gtggagtaac a

41

<210> 8
<211> 41
<212> DNA
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:SYNTHETIC DNA

<400> 8
cagatccata tcgtccatct tatggtcgtg ctgaaactgt t

41

<210> 9
<211> 41
<212> DNA
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:SYNTHETIC DNA

<400> 9
attaacaaca gtttcagcac gaccataaga tggacgatat g

41

<210> 10
<211> 41
<212> DNA
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:SYNTHETIC DNA

<400> 10
gttaataatt atattcgtaa atggcaacaa gtttattctc a 41

<210> 11
<211> 41
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:SYNTHETIC DNA

<400> 11
tcacgatgag aataaacttg ttgccattta cgaatataat t 41

<210> 12
<211> 41
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:SYNTHETIC DNA

<400> 12
tcgtgatggt cgtaaacaac aaatgactga agaacaacgt g 41

<210> 13
<211> 41
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:SYNTHETIC DNA

<400> 13
gccattcaag ttgttcttca gtcatttggt gtttaacgacc a 41

<210> 14
<211> 42
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:SYNTHETIC DNA

<400> 14
aatggctgtc ttatggttgc gttggtgtta cttgggttaa ca 42

<210> 15
<211> 40
<212> DNA
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:SYNTHETIC DNA

<400> 15

agcttggttaa cccaagtaac accaacgcaa ccataagaca

40

<210> 16

<211> 38

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:SYNTHETIC DNA

<400> 16

aattcggttaa ctctggtcag tatccgacta accgtctg

38

<210> 17

<211> 41

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:SYNTHETIC DNA

<400> 17

cgaatgccag acggttagtc ggatactgac cagagttaac g

41

<210> 18

<211> 49

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:SYNTHETIC DNA

<400> 18

gcattcgctt ccttcgatga agatcgtttc aagaacgaac tgaagaacg

49

<210> 19

<211> 49

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:SYNTHETIC DNA

<400> 19

ggacgaccgt tcttcagttc gttcttgaaa cgatcttcat cgaaggaag

49

<210> 20

<211> 35
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Description of Artificial Sequence:SYNTHETIC DNA

 <400> 20
 gtcgtccgcg ttctggtgaa actcgtgctg aattc 35

 <210> 21
 <211> 35
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Description of Artificial Sequence:SYNTHETIC DNA

 <400> 21
 gaccttcgaa ttcagcacga gtttcaccag aacgc 35

 <210> 22
 <211> 48
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Description of Artificial Sequence:SYNTHETIC DNA

 <400> 22
 gaaggtcgtg ttgctaagga atccttcgat gaagagaaag gcttccag 48

 <210> 23
 <211> 48
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Description of Artificial Sequence:SYNTHETIC DNA

 <400> 23
 gagcacgctg gaagcctttc tcttcacga aggattcctt agcaacac 48

 <210> 24
 <211> 42
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Description of Artificial Sequence:SYNTHETIC DNA

 <400> 24

cgtgctcgtg aagttgcttc tgttatgaac cgtgctctag aa

42

<210> 25

<211> 39

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:SYNTHETIC DNA

<400> 25

agctttctag agcacggttc ataacagaag caacttcac

39

<210> 26

<211> 45

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:SYNTHETIC DNA

<400> 26

aattctctag agaacgctca tgatgaatct gcttacctgg ataac

45

<210> 27

<211> 50

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:SYNTHETIC DNA

<400> 27

cttcttcagg ttatccaggt aagcagattc atcatgagcg ttctctagag

50

<210> 28

<211> 49

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:SYNTHETIC DNA

<400> 28

ctgaagaagg aactggctaa cggtaacgat gctctgcgta acgaagatg

49

<210> 29

<211> 49

<212> DNA

<213> Artificial Sequence

<220>
 <223> Description of Artificial Sequence:SYNTHETIC DNA

 <400> 29
 gagaacgagc atcttcgta cgcagagcat cgttaccgtt agccagttc 49

 <210> 30
 <211> 40
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Description of Artificial Sequence:SYNTHETIC DNA

 <400> 30
 ctcgtttctcc gttctactct gctctgcgta acactccgtc 40

 <210> 31
 <211> 39
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Description of Artificial Sequence:SYNTHETIC DNA

 <400> 31
 ctttgaagga cggagtgtta cgcagagcag agtagaacg 39

 <210> 32
 <211> 47
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Description of Artificial Sequence:SYNTHETIC DNA

 <400> 32
 cttcaaagaa cgtaacgggtg gtaaccatga tccgtctcgt atgaaag 47

 <210> 33
 <211> 47
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Description of Artificial Sequence:SYNTHETIC DNA

 <400> 33
 gataacagct ttcatacgag acggatcatg gttaccaccg ttacgtt 47

 <210> 34

<211> 45
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:SYNTHETIC DNA

<400> 34
ctggttatcta ctctaaacat ttctgggtctg gtcaggatag atcta

45

<210> 35
<211> 41
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:SYNTHETIC DNA

<400> 35
agcttagatc tatcctgacc agaccagaaa tgtttagagt a

41

<210> 36
<211> 42
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:SYNTHETIC DNA

<400> 36
aattcagatc ttcttctgct gataaacgta aatacgggtga tc

42

<210> 37
<211> 44
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:SYNTHETIC DNA

<400> 37
catccggatc accgtattta cgtttatcag cagaagaaga tctg

44

<210> 38
<211> 48
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:SYNTHETIC DNA

<400> 38

cggatgcatt ccgtccggct ccgggtactg gtctggtaga catgtctc

48

<210> 39

<211> 48

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:SYNTHETIC DNA

<400> 39

gatacagaga catgtctacc agaccagtac ccggagccgg acggaatg

48

<210> 40

<211> 35

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:SYNTHETIC DNA

<400> 40

gtgatacgttaa catcccgcgt tctccgactt ctccg

35

<210> 41

<211> 36

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:SYNTHETIC DNA

<400> 41

cttcacccgg agaagtcgga gaacgcggga tggttac

36

<210> 42

<211> 40

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:SYNTHETIC DNA

<400> 42

ggtgaaggct tcgttaactt cgattacggt tggttcggtg

40

<210> 43

<211> 40

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:SYNTHETIC DNA

<400> 43

gtctgagcac cgaaccaacc gtaatcgaag ttaacgaagc

40

<210> 44

<211> 44

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:SYNTHETIC DNA

<400> 44

ctcagactga agctgatgct gataagactg tatggaccca tgga

44

<210> 45

<211> 41

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:SYNTHETIC DNA

<400> 45

agcttccatg ggtccataca gtcttatcag catcagcttc a

41

<210> 46

<211> 39

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:SYNTHETIC DNA

<400> 46

aattcccacg gtaaccatta ccatgctccg aacggttct

39

<210> 47

<211> 42

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:SYNTHETIC DNA

<400> 47

cacccagaga accgttcgga gcatggtaat gggttaccatg gg

42

<210> 48

<211> 41
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Description of Artificial Sequence:SYNTHETIC DNA

 <400> 48
 ctgggtgcta tgcatgtata cgaatctaaa ttccgtaact g 41

 <210> 49
 <211> 42
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Description of Artificial Sequence:SYNTHETIC DNA

 <400> 49
 cttcagacca gttacggaat ttagattcgt atacatgcat ag 42

 <210> 50
 <211> 37
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Description of Artificial Sequence:SYNTHETIC DNA

 <400> 50
 gtctgaaggt tactctgact tcgatcgtgg tgcttac 37

 <210> 51
 <211> 37
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Description of Artificial Sequence:SYNTHETIC DNA

 <400> 51
 gtgataacgt aagcaccacg atcgaagtca gagtaac 37

 <210> 52
 <211> 38
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Description of Artificial Sequence:SYNTHETIC DNA

 <400> 52

gttatcacct tcattccgaa atcttggaac actgctcc

38

<210> 53

<211> 38

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:SYNTHETIC DNA

<400> 53

ctttgtccgg agcagtgttc caagatttcg gaatgaag

38

<210> 54

<211> 38

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:SYNTHETIC DNA

<400> 54

ggacaaagtt aaacagggtt ggccgtaatg aaagctta

38

<210> 55

<211> 34

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:SYNTHETIC DNA

<400> 55

agcttaagct ttcattacgg ccaaccctgt ttaa

34

<210> 56

<211> 20

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:SYNTHETIC DNA

<400> 56

ttttcccagt cacgacgttg

20

<210> 57

<211> 21

<212> DNA

<213> Artificial Sequence

<220>
 <223> Description of Artificial Sequence:SYNTHETIC DNA

 <400> 57
 caggaaacag ctatgaccat g 21

 <210> 58
 <211> 36
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Description of Artificial Sequence:SYNTHETIC DNA

 <400> 58
 taaggagggtt taaaatgtct gacgatcgtg ttactc 36

 <210> 59
 <211> 21
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Description of Artificial Sequence:SYNTHETIC DNA

 <400> 59
 tacgccaagg ttgttaaccc a 21

 <210> 60
 <211> 5
 <212> PRT
 <213> Artificial Sequence

 <220>
 <223> Description of Artificial Sequence:N-TERMINAL
 FRAGMENT

 <400> 60
 Ser Asp Asp Arg Val
 1 5

 <210> 61
 <211> 15
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Description of Artificial Sequence:CODON FOR
 N-TERMINAL FRAGMENT

 <400> 61
 tctgacgatc gtggtt 15

```
<220>
<223> Description of Artificial Sequence:N-TERMINAL
      FRAGMENT
```

```
<400> 62
Met Ser Asp Asp Arg
  1                               5
```

Year	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099
1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	